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THE COMPOSITION OF COMMERCIAL FRUIT EXTRACTS.

WALTER S. LONG.

ACCORDING to federal and state standards, a flavoring extract is a solution, in ethyl alcohol of proper strength, of the sapid and odorous principles derived from an aromatic plant, or parts of the plant, with or without its coloring matter, and without added coloring matter, and conforms in name to the plant used in its preparation.

There are on the Kansas market a large number of products which are represented and labeled as fruit extracts. There are, for example, extracts of strawberry, pineapple, blackberry, raspberry, cherry and banana. Some work has been done at the food laboratory of the State Board of Health at Lawrence with the view of securing data which would serve as an aid in determining the genuineness of such products.

The commercial products themselves were first subjected to analysis. These were found to be weak alcoholic solutions, leaving on evaporation a sirupy residue, which on burning left an ash. Analysis of the ash showed it to have the characteristics of the ash of fruits. On treating the original extract with subacetate of lead a heavy precipitate formed, showing the presence of solids other than sugars in solution.

On the basis of the information thus gained, alcoholic extracts of various fruits were made in the laboratory. The process consisted in macerating the whole fruit, finely ground, for a week or more with strong alcohol, then pressing out through cheese cloth and finally filtering through paper. These clear extracts were then analyzed. A comparison of the data thus obtained with that from the commercial products showed a very close agreement, as shown in the tables at the close of this paper.

To determine in what respects, if any, an alcoholic extract of a fruit differs from the fruit juice itself, analysis was made of an extract of the fruit in whose preparation water was used instead of alcohol. The results showed no appreciable difference except in the alcoholic content.

To show the effect of glycerine and sugar together with alcohol as extractive agents, extracts of this nature were prepared and analyzed, with results similar to those obtained with alcohol alone or water alone.

The above remarks and conclusions are based upon analysis representing determinations of alcohol, total solids, total ash, soluble and insoluble ash, total alkalinity of ash, and the alkalinity of the soluble ash. These serve as aids in establishing an extract as a fruit product only, and give no information regarding the identity of the extract or its value as a flavor. As a means of differentiating between extracts of various fruits, it was found in the case of the laboratory-made extracts that certain reagents when added directly to the extracts gave characteristically colored precipitates. For example, a mixture of alum and sodium carbonate gave for pineapple a white precipitate, for strawberry a cream-colored precipitate, for raspberry a brown, for cherry a bluish gray, and for blackberry a deep blue. Similar results were obtained with normal lead acetate and basic lead acetate, the colors differing from those in the case of alum, but being quite as characteristic.

To determine the value of the extracts as flavoring material, rather extensive tests were made by the department of home economics at the University. These tests showed conclusively that these extracts are practically worthless as flavoring agents for pastry products. These results were anticipated from the fact that, with possibly one exception, namely, the extract of pineapple, it is impossible to identify these products by taste or odor.

In short, fruit extracts are flavors in name only. They contain no "sapid and odorous principles derived from an aromatic plant or parts of the plant." In this respect they fail to comply with the legal standards. However, they do contain the plant's coloring matter, and this in abundance, and in this respect they conform to the standard and to the name of the plants used in their preparation.

TABLE I.—*Commercial fruit extracts.*

No.	Alcohol, vol.	Grams per 100 cc.			cc. N-10 acid per 100 cc.		Percent ash in solids.	Normal lead No.
		Solids.	Ash, solids.	Ash.	Alk. total ash.	Alk. sol. ash.		
				PINEAPPLE.				
1	34.20	16.78	0.74	0.64	63.5	42.0	4.41	1.624
2	27.60	14.37	0.58	0.43	70.2	38.2	4.04	1.526
3	33.43	12.34	0.09	....	....	....	6.73	0.200
4	35.90	16.56	0.73	....	....	....	4.41	1.740
5	36.24	18.09	0.71	....	....	....	3.93	1.740
				STRAWBERRY.				
6	33.95	8.64	1.00	0.88	73.5	51.0	11.57	1.885
7	34.50	8.94	0.60	....	....	....	6.71	2.160
8	45.20	1.17	0.36	0.31	20.3	6.8	3.08	....
9	32.20	7.17	0.59	0.47	79.6	51.1	8.23	1.881
				RASPBERRY.				
10	41.53	24.27	0.72	....	....	....	2.97	1.400
11	30.60	21.37	0.44	0.33	55.5	30.0	2.06	1.437
12	42.40	2.57	0.02	0.016	17.5	5.5	0.80	....
13	48.20	5.15	0.07	0.02	13.7	2.7	1.30	....
14	25.80	5.20	0.09	0.03	16.7	6.2	1.00	....
15	41.00	23.26	0.70	0.58	81.0	51.0	3.00	1.881
				CHERRY.				
16	34.60	17.57	0.69	0.58	88.5	69.0	3.98	1.218
17	29.00	8.09	0.35	0.25	53.5	35.5	4.32	....
18	31.23	17.72	0.64	....	....	....	3.61	1.220

Numbers 8, 12, and 13 were labeled as imitation extracts.

TABLE 2.—*Laboratory-made extracts.*

No.	Nature of extractive agent.	Alcohol vol.	Grams per 100 cc.			cc. N-10 acid per 100 cc.		Ash in solids.
			Solids.	Ash.	Sol. ash.	Alk. ash.	Alk. sol., ash.	
	PINEAPPLE.							
19	Alcohol	43.65	7.00	0.24	0.17	38.5	23.5	3.43
	BLACKBERRY.							
20	Alcohol	45.20	7.81	0.34	0.25	47.1	23.1	4.35
	STRAWBERRY.							
21	Alcohol	52.34	2.43	0.25	0.22	24.8	19.5	10.10
22	Alcohol	28.73	1.91	0.12	0.11	16.5	13.0	6.13
23	Alcohol + Glycerol	52.04	10.86	0.19	0.17	20.8	16.0	....
24	Alcohol + Glycerol	48.42	12.92	0.20	0.18	20.0	15.3	....
25	Water	1.46	6.18	0.18	0.16	30.5	24.0	....
	CHERRY.							
26	Alcohol	49.90	8.37	0.27	0.23	30.3	25.3	3.19
27	Alcohol	29.24	7.78	0.26	0.23	29.5	26.5	3.35
28	Alcohol + Glycerol	51.23	15.14	0.24	0.22	28.5	23.8	....
29	Alcohol + Sugar	49.95	18.11	0.28	0.25	30.2	24.5	....
30	Water	0.32	8.00	0.33	0.29	....	35.0	....

Note proportion of material used in—

(*a*) Alcoholic extracts:

(1) Fruit, 50 percent; strong alcohol, 50 percent.

(2) Fruit, 50 percent; strong alchol, 25 percent; water, 25 percent.

(*b*) Alcohol-glycerol extracts: Fruit, 45 percent; alcohol, 45 percent; glycerol, 10 percent.

(*c*) Alcohol-sugar extracts: Fruit, 45 percent; alcohol, 45 percent; sugar, 10 percent.

(*d*) Water extracts: Fruit, 50 percent; water, 50 percent.

TABLE 3.—*Volume and color of precipitates and color of filtrates with precipitation reagents.*

	Basic lead acetate (Sp. Gr. 1.25).			Normal lead acetate (80 gms. per 1.)			Alum and sodium carbonate (60%).		
	6 vol.	*Lake.*	*Fil.*	*Vol.*	*Lake.*	*Fil.*	*Vol.*	*Lake.*	*Fil.*
Pineapple	3.5	Light cream	Colorless	2.20	Light cream	Colorless	0.80	White	Nearly colorless.
Strawberry	3.3	Gray	Colorless	2.30	Flesh	Pink	0.60	Cream	Reddish.
Raspberry	5.3	Dark gray	Colorless	3.50	Chocolate	Dark read	0.30	Brown	Dark red.
Cherry	3.2	Light green	Colorless	2.00	Gray blue	Pink	....	Gray blue	Red.
Blackberry	2.9	Green-blue	Colorless	2.40	Dark blue	Purple	1.00	Blue	Deep purple.

NOTE.—The method used to obtain the results indicated in the above table was as follows: 5 cc. of the extract and 2 cc. of the reagent were placed in a Hortvet tube, thoroughly mixed and centrifuged for five minutes, and the volume and color of precipitate and color of supernatant liquid noted. Volume is expressed in cc.

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